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ORIGINAL ARTICLE

A Genetic-Neuro-Fuzzy inferential model for diagnosis of tuberculosis

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Abstract Tuberculosis is a social, re-emerging infectious disease with medical implications throughout the globe. Despite efforts, the coverage of tuberculosis disease (with HIV prevalence) in Nigeria rose from 2.2% in 1991 to 22% in 2013 and the orthodox diagnosis methods available for Tuberculosis diagnosis were been faced with a number of challenges which can, if measure not taken, increase the spread rate; hence, there is a need for aid in diagnosis of the disease. This study proposes a technique for intelligent diagnosis of TB using Genetic-Neuro-Fuzzy Inferential method to provide a decision support platform that can assist medical practitioners in administering accurate, timely, and cost effective diagnosis of Tuberculosis. Performance evaluation observed, using a case study of 10 patients from St. Francis Catholic Hospital Okpara-In-Land

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(Delta State, Nigeria), shows sensitivity and accuracy results of 60% and 70% respectively which are within the acceptable range of predefined by domain experts.

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1. Introduction

Tuberculosis (TB) is a social, re-emerging infectious disease that has medical implications throughout the globe [1]. The largest single cause of adult illness and death from the communicable disease is caused by Mycobacterium Tuberculosis [2]. Nigeria has made great strides in increasing access to Directly Observed Therapy Short-course (DOTS) for TB yet, coverage, which was 45% in 1999, had reached 75% by 2005 while treatment success for 2005 cohort was 75% [3]. Although TB incidence in Nigeria is below the normal level for Sub-Saharan Africa, but it remains high at a rate of 311 cases per 100 grand population members in 2006. The trends for both Nigeria and Sub-Saharan Africa, as depicted in Fig. 1, show a slight downward turn of TB incidence since 2003. Still with 250 grand new cases each year, a mortality rate of 81 deaths per 100,000 spells the disease as high burden on Nigeria [4].

The World Health Organization (WHO) estimated in 2006, that each year, more than 8 million new cases of TB occur and approximately 3 million persons die from the disease [4,5] and estimated that between 19% and 43% of the world's population will be infected with Mycobacterium Tuberculosis. Within the past decade it has become clear that the spread of HIV infection and the immigration of persons from areas of high incidence have resulted in increased numbers of TB cases. It has always occurred disproportionately among disadvantaged populations such as the homeless, malnourished, and overcrowded [6]. Today, several methods for the diagnosis of TB have been proposed. Tuberculin Test, Radiological Examination, and Sputum Smear Microscopy are common conventional approaches however in the last 10 years, several molecular methods have been developed for direct detection, identification and susceptibility testing of mycobacteria [7].

Orthodox methods of diagnosing TB are primarily through physical examination and laboratory tests. The former involves asking patients certain questions for prognosis purposes while tests are carried out to affirm physical examination. Diagnosis can be stopped if medical practitioner is totally convinced after physical examination however, this is not advised. This orthodox method is currently faced with a number of challenges such as lack of medical facilities in most medical centers and as a result, inhibiting the management of TB in developing countries.

The strength of IT in providing an effective and efficient solution to real life problems has been explored to aid scientific discoveries and advancement of different fields of medicine [8]. Hence, to reduce the morbidity and mortality rates in

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